

University of Bristol

MECHANICAL SAFETY

Code of Practice

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INTRODUCTION

The Health and Safety at Work Act 1974, to which the University is subject as an employer, imposes duties on the University to run a safe place of work. Primarily, the precautions contained in this Code of Practice are intended to prevent injury to individuals in the University, whether staff, students or visitors. In addition compliance with the Code of Practice by all will enable the University to meet its legal duties under the 1974 Health and Safety Act and subordinate legislation.

The first part of the Code concerns general work equipment safety whilst the second part addresses the procedures necessary to meet current HSE legislation concerning specific mechanical systems and hazards. If any person has reason whereby they cannot comply with this Code of Practice, they should inform their immediate superior, Departmental Safety Advisor or the Safety Office.

Many accidents in the workplace are caused by tripping or falling over objects left in walkways and in workspaces or slipping on spillages of oil or other liquids from badly sited or unsuitable containers. There is therefore a general requirement over and above the specific requirements that follow in this Code of Practice for a good housekeeping policy to be adopted throughout the University and especially in potentially hazardous situations such as workshops and laboratories.

Equipment no longer in use should be disposed of, material not immediately required should be put away in cupboards or other properly designed storage places and fire exits and routes must be kept clear at all times.

A further general requirement arises out of the Management of Health and Safety at Work Regulations 1992. These require a risk assessment to be carried out for all hazardous activities being carried out in the University. Many such activities are already the subject of assessments under other regulations (e.g. The Control of Substances Hazardous to Health Regulations 1994), but the remainder will need identification and appropriate action taken. This is discussed later in the Supervisory Control Section (Assessments). The University has also produced a Risk Assessment Code of Practice to which reference should be made.

GENERAL

Work equipment, as defined under The Provision and Use of Work Equipment Regulations 1998, includes almost every piece of equipment in the University (see Appendix A)

Consequently, not only are machines included, i.e. equipment with moving parts, but also static equipment such as ladders, scaffolding, hand tools etc. The Regulations require all work equipment which, on becoming defective could be hazardous, to be subject to a routine preventative testing and/or maintenance programme. For many categories of equipment this is already called for under equipment specific regulations (see appendix C) and is detailed in the appropriate University Safety Code of Practice. For example, electrical testing (portable and fixed equipment electrical equipment and installations) is included in the Electrical Safety Code of Practice. Testing of Fume Cupboards is detailed in the Control of Substances Hazardous to Health (COSHH) Code of Practice and testing of pressure vessels and lifting gear are contained within the Mechanical Code of Practice. **(To assist departments a detailed list of equipment subject to statutory examinations/inspections/test and the organisations responsible, is shown at Appendix 3)**

For equipment not subject to statutory examination/inspection it is recommended that periodic inspections be carried out as part of departmental safety inspections. All work equipment should be assessed and those items that could be hazardous when defective should be subjected to appropriate maintenance/testing routines if these are not already in place. Examples include ladders, stepladders etc which should be serial numbered and subject to periodic examination, normally 6 monthly. The details should be held in a simple register.

PART I

WORK EQUIPMENT SAFETY

PURCHASING NEW OR SECOND-HAND WORK EQUIPMENT

All work equipment must now comply with appropriate European Union Community Directives relating to construction, design and essential (mandatory) safety requirements. New work equipment must display a "CE" mark which indicates that the equipment complies with the appropriate European Directives. The presence of the "CE" mark does not however absolve the buyer from prosecution should the work equipment be found to be unsafe and therefore the work equipment should be examined to ensure that it is in fact safe. The company supplying the equipment should also be requested to supply the relevant certification and declarations applicable to the equipment. This included appropriate operating instructions, maintenance schedules and details of hazards associated with the work equipment.

Second-hand work equipment should be considered as new and must have the essential safety requirements as laid down by the relevant Community Directives. The Safety Office should be consulted if there is any doubt as to the safety of any work equipment.

MACHINES

- a) Provision and Use of Work Equipment Regulations 1998 (PUWER).
- b) The Management of Health and Safety at Work Regulations 1992 (MHASAW)

A machine is defined as an apparatus for applying power, having fixed and moving parts, each with definite functions. A mechanical system comprises a series of machines, which may or may not be physically connected, but whose combined function achieves a specific purpose. The principles for reducing risk of injury from machinery as a result of mechanical hazards are as follows:

- a. Identification of the hazard;
- b. Elimination or reduction of the hazard by design;
- c. Provision of effective safety mechanisms;
- d. Implementation of safe working practices and periodic safety inspections.

Regulation 11 of PUWER 98 specifies the measures that should be taken to prevent access to dangerous parts of machinery and are ranked in the order that they should be implemented:

- a. Fixed enclosed guards
- b. Other guards or protection devices such as interlocked guards and pressure mats;
- c. Protection appliances such as jigs, holders and push sticks etc; and
- d. The provision of information, instruction, training and supervision.

The University has many machines in workshops, laboratories and plant rooms but does not in general design machines. This Code of Practice will therefore concentrate on the use of equipment applicable to the University. A more comprehensive Code of Practice on general machine safety (BS EN 292) together with safety Codes of Practice for specific types of machine are available from the Safety Office who should be consulted in case of difficulty or doubt. **Departments who design and manufacture machines and/or work equipment for sale for use at work should refer to the Safety Office for advice on relevant legislation.**

HAZARDS

Machinery hazards fall into one of the following categories:

- a. Contact or entanglement with machinery
- b. Trapping between the machine and fixed structures
- c. Contact or entanglement with any material in motion
- d. Being struck by material ejected from machinery
- e. Stabbing and puncture by machinery or materials
- f. Exposure to hazardous substances (Fume, aerosols etc)
- g. Noise
- h. Extremes of temperature (Hot and Cold)
- i. Ionising and non- ionising radiation
- j. Electricity
- k. Pressures and Vacuum
- l. etc

Machinery should have been designed to prevent injury due to such hazards. Nevertheless equipment should still be inspected by departments with a critical eye to ensure that no possible hazard has been overlooked, especially those arising out of the interface between the machine itself and the surrounding environment and fixed structures, at its place of use.

SAFETY MECHANISMS

Guards. All projections such as set screws and lugs on any exposed revolving part should be sunk, shrouded or otherwise effectively guarded so as to prevent injury to an operator or maintainer in the vicinity. Guards for rotating shafts and belt drives should preferably be of the fixed type and be of solid construction. Where operators have to gain access to a machine as part of the production process, then moveable guards need to be considered and in most circumstances should be interlocked to prevent power being applied whilst the guards are out of position. BS5304: 1988 describes various guarding techniques and their applicability to different situations and types of machine and should be consulted where necessary.

Stability. All machines should be steady and stable during operation and this means that in most cases they should be firmly bolted to the floor. Exceptions are small portable machines on stands and even then the latter should be designed to remain steady whilst in use.

Inspections. Regular departmental inspections are essential. The periodicity of such inspections would depend on the degree of hazard involved and the likelihood of safety features failing but a general recommendation would be for one to be carried out a least once a year and for higher hazard areas such as workshops, once every 6 months. At Appendix B of the Safety Audit Code of Practice is the checklist used by the safety auditors when conducting the random check part of the audit. It can usefully be used as a basis for a departmental inspection checklist. In addition, the opportunity should be taken during the inspection to:

- a. Note equipment which has the potential to cause a hazard on becoming defective and, in such cases, to ensure regular testing and preventative maintenance routines are carried out. Thus maintenance of guards, interlocks and other safety design features are essential and should be arranged by the department responsible for the machinery.
- b. Note any hazardous activity and, if it is not already the subject of a Risk Assessment, write one and ensure that the findings are implemented (See University Code of Practice on Risk Assessments).

SAFE WORKING PRACTICES

Designing machinery for safety such as the provision of guarding as described above is one of the two major contributors to reducing accidents. The other is the adoption of safe working practices by personnel

whether they are operators or maintainers.

Operation of machines

Training. Equipment should only be used by people who have been trained in the use of that equipment and a record kept that such training has been given. (An example of such a record is shown in Appendix B).

Safe access. Firm footholds (and handholds where necessary) should be provided to prevent operators of the equipment inadvertently stumbling into the machinery. Access by persons not directly involved with the use of the machinery, especially where it cannot be fully guarded, should be prevented. Where the hazard is great, barriers should be created. Marking on the floor with tape or other material an area around the machine into which only authorised people are allowed, may be suitable in supervised areas.

Entanglement. Loose clothing, neckties, gloves, rings and other jewellery, long hair (unless tied back and/or covered up), fabric first aid dressings and bandages and any other material likely to be entangled by the machinery should be avoided. Close fitting overalls with no external pockets should be worn.

Eye and skin protection. Appropriate eye protection (spectacles, goggles or a face mask), should be worn where there is a hazard of flying objects, small particles or dust arising out of the use of the machinery. Where cutting oils and similar liquids are in use, **dermatitis** presents a real hazard. Exposed skin should be protected by gloves, barrier creams and good hygiene practices, (following a suitable risk assessment).

Foot protection. Many accidents can be avoided by the wearing of boots or shoes having built-in steel toecaps and reinforced, non-skid soles, especially in areas where oil is present or heavy equipment is being moved. Workshop staff and plant operators should therefore be encouraged to use such approved safety footwear. The Safety Office can supply the necessary details.

Closeness of approach to the hazard area should be limited to the minimum necessary. In the case of workshop machinery, the use of manual handling devices for the material being worked on should be considered, e.g. tongs for forging work, push sticks for circular saws and spindle moulding, push blocks for planing machines etc.

Emergency stop controls should be readily accessible to the operator at any of the positions where he is likely to be situated in the course of operating the machinery. Consideration should also be given to siting an emergency stop switch at the entrance to workshops and laboratories so that power to all the services in the room can be readily disconnected should an accident occur or a hazardous situation arise.

Maintenance of machinery

Although safeguards may have been provided which prevent access during most phases of a machine's life, these often have to be removed or their purpose nullified in some way to allow machinery to be set up, maintained or inspected. These latter activities often require personnel to work on the internals of the machine and therefore precautions additional to those above need to be taken to prevent inadvertent movement of the moving parts and hence possible injury, by isolating the source of power.

Isolation. The source of power can be isolated in various ways depending on the nature of the system. Below are some of the ways it can be achieved:

- a. **Mechanical power:** isolation of clutches, removal of drive belts or chains;
- b. **Electrical power:** isolation switches, removal of fuses, removal of plugs from sockets;
- c. **Hydraulic power:** isolating valves, electrical isolation of pumps;
- d. **Services:** isolating water, steam, gas or fuel.

Energy dissipation. Residual stored energy in a machine needs to be dissipated before access into the machine is allowed. This is achieved as follows:

- a. Mechanical power: allowing flywheels or high speed rotating parts, e.g. centrifuge bowls, to run down completely;
- b. Electrical power: discharging capacitors and then maintaining a short circuit across their output terminals or disconnecting stand-by batteries;
- c. Hydraulic power: discharging accumulators or relaxing pressurised pipework;
- d. Services: venting residual steam, purging gas or draining fuel.

After isolation of the power sources and the dissipation of residual energy but before entry to the machine, a check should be made to ensure no further hazard exists. Positive measures also need to be taken to prevent the power source being reconnected inadvertently, especially where the isolation mechanism is remote from the machinery. Such measures include the use of padlocks to lock valves or switches in the "off" position with the key being held by the person attending the machine, or the removal and retention by the maintainer of appropriate fuses etc. Warning notices should also be used, informing those not involved with the activity that a particular machine is being worked on with the instruction not to interfere with the relevant power supplies.

SUPERVISORY CONTROL

Supervisory control of machinery operations is essential to ensure good, safe working practices are adopted by operators and maintainers, especially where full protection cannot be obtained by technical means.

Assessments. As indicated in the Risk Assessment Code of Practice, there is a general requirement to carry out a risk assessment wherever a hazardous situation exists. It is recommended that the following procedure be used:

- a. Identify any hazardous activity being undertaken in the department. Most conveniently this can be done during the regular departmental safety inspection.
- b. With each hazardous activity the Supervisor or other competent person appointed by the Head of Department should prepare an assessment which, as a minimum, should include:
 - i. Description of activity;
 - ii. The hazards likely to be encountered;
 - iii. Details of those exposed to the hazards;
 - iv. The procedure to be adopted to minimise the hazard;
 - v. Emergency precautions to be taken in case of accidents;
 - vi. Any special training requirements for those taking part.
- c. Issue the assessment to those concerned for their use and, if appropriate, include a copy in the department's local administration orders or local rules. (Examples of Risk Assessments on Machinery can be found in the Risk Assessment Code of Practice).

Approved Scheme of Work. Some departments have Approved Schemes of Work for certain activities and these can be regarded as the assessment provided they cover the headings above.

Permit to Work. In extreme cases where the hazard is great, a Permit to Work system should be considered, e.g. when working in confined spaces or working with high voltages. The latter requires formal action on the part of those doing the work, those responsible for it and those authorising it. The Safety Office should be informed and will assist in the preparation of the Permit to Work form, the design of which will depend on the nature of the work. Departments should promulgate a list of situations requiring a Permit to Work so that staff are obliged to apply for them whenever such a contingency may arise. They should be reminded to do so by suitable notices in the workplace.

PART II

SPECIFIC SYSTEMS

ABRASIVE WHEELS

- a. HSE Guidance Note PM22 - Training Advice on the Mounting of Abrasive Wheels.

Abrasive wheels are potentially dangerous because of their high speed of rotation with the resultant possibility of break-up under centrifugal stress.

For these reasons, only properly trained and nominated people may mount new wheels. A register of people trained in this skill should be maintained by the department and copied to the Safety Office.

A summary of basic safety instructions is listed below:

- a. Isolate the power supply before adjusting or working on an abrasive wheel installation.
- b. Check that the speed of the spindle does not exceed that marked on the wheel. Do not mount a wheel on a machine for which it is not intended.
- c. Brush, clean and examine for any damage a new wheel before mounting.
- d. Make sure that there is a blotter (a large washer) on each side of the wheel when mounted.
- e. When securing a new wheel, ensure that the direction of tightening the flange nuts is opposite to the direction of rotation of the wheel and that nuts are just tightened sufficiently to cause the wheel to be driven. Over tightening may cause the wheel to crack.

Operators of abrasive wheels must take full and proper account of the safety mechanisms provided, e.g. guards and rests for the workpieces, and properly fitting eye protection should always be worn to prevent injury due to flying particles.

HANDLING LOADS

- a. Manual Handling Operations Regulations 1992
- b. Manual Handling Code of Practice.

Manual lifting. For convenience and speed many people will be tempted to lift a load manually which is too heavy or too awkwardly placed to be moved without causing damage to their backs. Handling loads is one of the major causes of industrial accidents.

No person should attempt or should be asked to lift a weight that is too heavy for him/her and if there is any doubt, persons should be encouraged to make a trial lift of only a few centimetres in the first instance. If the activity involves twisting while holding the load, repetitive lifting or lowering or carrying over a long distance, then the load figures should be modified downwards. If the person concerned is of above average strength and build, they could be modified upwards.

The Manual Handling Regulations require an assessment to be carried out when or wherever a handling activity gives rise to a risk of injury being involved. The assessment should be a written statement which logically examines the factors involved in order to arrive at a means. The University "Manual Handling Code of Practice" contains relevant information and example assessment forms.

Lifting equipment. Lifting equipment is usually classified into one of two categories: either as lifting appliances (the machines and devices which perform the lifting operations) or as lifting gear (the equipment used to connect the load to the lifting appliance). There are statutory legal requirements to be observed as regards the periodic testing of both classes. The Works and Buildings department (Building and Services Group Manager) co-ordinates the testing throughout the University. Departments are nevertheless responsible for the safety and serviceability of their own equipment. Departments must inform the Works and Buildings Department of any lifting equipment being purchased or discarded so that the central list used for arranging the tests can be kept up to date. Only equipment that is registered as being within its test period should be used. . **Note:** Personal Safety Harness will also require 6 monthly statutory examination through Works and Buildings (see Appendix 3)

Safe loading limits must be clearly marked on each piece of equipment and steps taken to ensure those limits shall not be exceeded. The latter requires a knowledge of the weight of the item to be lifted. Before carrying out any lifting operation, all lifting gear involved shall be visually inspected and any damaged items, e.g. chafed ropes, distorted chain links etc, should be rejected for use and should be either disposed of or repaired and re-tested. Wire rope with the odd strand broken can still be used but should there be 5% or more broken wires showing in any length of 10 m then the rope should be considered to be unserviceable. Staff involved in lifting operations must be deemed competent and hence it may be necessary to provide training in slinging techniques

To avoid casual damage to lifting gear, departments are advised to keep all such tackle in a departmental

store and only to issue items as and when they are required for use.

Fork Lift Trucks. Forklift trucks are only to be operated by persons who have obtained a certificate having attended an authorised fork lift truck drivers' course. These can be organised by the Safety Office. The Safety Office also holds the official list of registered forklift truck drivers. Guidance on the safe operation of lift trucks is given in a Health and Safety Publication HS(G) 6 titled 'Safety in Working with Lift Trucks' and should be read by all fork lift drivers and their supervisors. The lifting chain part of the truck should also be examined at 6 monthly periods (see appendix 3)

PRESSURE SYSTEMS

- a. Pressure Systems and Transportable Gas Containers Regulations 1989 and the associated HSE guidance.
- b. Associated Offices Technical Committee (AOTC) guidance booklets -
 - i. Examination of pressure systems (other than those containing steam or compressed air)
 - ii. Examination of compressed air systems
 - iii. Examination of transportable gas containers
 - iv. Examination of steam and pressurised hot water systems.

The aim of the Regulations is to prevent hazard to people and property by the inadvertent release of the stored energy inherent in a gas system under pressure. To achieve the aim for systems already in service (the category most applicable to the University), regular examination of the system by a 'competent' person or organisation is required.

At its simplest, a pressure system is defined under the Health and Safety Act as a system comprising one or more pressure vessels of rigid construction together with the associated pipework and protective devices which contains either steam at a pressure above atmospheric or a gas at a pressure greater than 0.5 Bar above atmospheric pressure (i.e. approximately 21 psi). There are, nevertheless, numerous systems which, while embraced by the above definition, are exempted from the Regulations because of their small size or because they are covered by other Regulations.

A comprehensive list of the systems in the University which are subject to the Pressure Regulations has been compiled and, as for lifting gear, this list is held by the Works and Buildings Department and detailed in Appendix 3. The former arranges for a 'competent' authority to carry out the required examinations on a University-wide basis. Depending on the nature of the system, the examinations involve some or all of the following techniques: visual, ultra-sonic, crack detection and other non-destructive testing methods. Departments which purchase pressure systems such as steam autoclaves, sterilisers etc are responsible for their operation, upkeep and examination and as such it is their responsibility to formally inform Works and Buildings Department of any change to their holdings so that the examinations will be carried out as required.

Transportable gas cylinders. Gas cylinders are subject to the Pressure Regulations and hence those departments who have bought and own cylinders have the responsibility for ensuring that they are included in the list of pressure systems to be tested. However, in most cases they are leased to the University by the Gas Company and the responsibility for testing them lies with the company. However any gas distribution system (either valves or pipework) will be subject to the regulations and should therefore also be registered with Works and Buildings for examination and test. Nevertheless, as users, departments will need to take their own of precautions with regard to the operation of gas cylinders, namely:

- a. They should only be used for the storage and supply and should not be used for other purposes, e.g. as rollers or supports.
- b. They should be safely stowed and secured when not being moved. This usually means securing in an upright position or strapped into a special frame.
- c. They should not be lifted by their valve cap or guard.
- d. They should not be lifted with magnets or chains. A rope or nylon sling may be used to lift one

- cylinder at a time provided it is correctly adjusted to prevent slippage.
- e. Oil and grease should not be used on valves and other fittings unless they are compatible with the gas in the cylinder; e.g. grease should not be used on oxygen cylinders because of the possibility of ignition.

Cylinders should be stored in a safe place in the open air or, if this is not possible, in an adequately ventilated building. They should not be allowed to stand or lie in water and should be protected from external heat sources that could affect their mechanical integrity.

If cylinders contain flammable gases, additional precautions are required (see page 12, Storage of Flammable Liquids).

WELDING

- a. HSE Guidance Note EH55 - The Control of Exposure to Fume from Welding, Brazing and Similar Processes.
- b. HSE Guidance Note EH54 - Assessment of exposure to fume from welding and allied processes.
- c. HSE Guidance Note MS15 - Welding.
- d. The Confined Spaces Regulations 1997.

Hazards

The main hazards likely to be encountered during welding and cutting processes are:

- a. High temperatures, causing burns and fires;
- b. Directly or indirectly produced fumes, liable to cause injury to health;
- c. Thermal radiation causing burns or ultra violet radiation (especially associated with electric arc welding) which causes damage to the eyes;
- d. Oxygen insufficiency or enrichment within a confined space;
- e. Explosions during the welding of tanks, drums and vessels which have not been fully freed of flammable contents.

These hazards to personnel and plant can be minimised by wearing suitable protective clothing and following laid down procedures, For this reason all potential welders must be given adequate training to cover both the operation of welding equipment and avoidance of the hazards involved. Departments should keep a register of their trained welders and restrict welding operations to those on the register.

In cases of working in a confined space being required, a Permit to Work system is generally appropriate and fume extraction facilities should be provided. Where a confined space is a tank that has contained a flammable liquid or gas, it needs to be purged with an inert gas or liquid before welding commences. In both cases, if a welder is required to enter the space, the atmosphere needs to be analysed for safety; i.e. to ensure that it is breathable and is not flammable or toxic,

Gas flame welding

- a. Highly Flammable Liquids and Liquefied Petroleum Gas Regulations 1972.

The gases most commonly used are oxygen, acetylene and propane. The storage, transport and use of the cylinders containing these gases are the subject of the above Regulations that in summary stipulate that:

- a. Fuel and oxygen supplies should be stored at least 6 m apart.
- b. Cylinders should be secured either in a trolley or lashed upright in a suitable support.
- c. Cylinders should not be rolled along the ground.

- d. Grease should not be used to lubricate fittings because of the dangers of ignition in the presence of oxygen.
- e. The proper fittings, hoses, regulators, gauge etc must always be used and makeshift arrangements avoided.

Purpose designed protective clothing should be used when gas welding, e.g. gas workers' goggles, leather aprons, jackets and gauntlets, to protect against sparks and molten metal burns.

Cylinders and hoses are colour coded. These and the valve thread details are given below:

Gas	Cylinder colour	Valve thread	Hose
Oxygen	Black	Right handed	Blue
Acetylene	Maroon	Left handed	Red
Propane	Red	Left handed	Orange

Acetylene cylinders are filled with a porous substance such as charcoal or kapok that is soaked with acetone to take up the acetylene gas. Because of their design, the cylinders should always be stored upright and because of the danger of an acetylene explosion when the gas is under pressure; the pressure of gaseous acetylene should not be allowed to exceed 0.63 bar (9 psi). There are many other safety features to be observed with acetylene systems (eg copper and copper alloys should not be used) and hence Safety Office should be consulted whenever an acetylene system is to be installed.

Electric arc welding

- a. HSE Guidance Note PM64 - Electrical Safety in Arc Welding

The electric supply for welding can be supplied either by a separate generating set or a transformer set fed from the mains. The arc voltage is normally of the order of 50 to 60 V DC or up to 100 V AC if AC is being used. The electrical safety precautions of earthing and insulation (see the University's Electrical Safety Code of Practice) apply as to other electrical equipment but due to the special nature of welding and its potential for passing high currents under fault conditions, special attention has to be paid to the prevention of fire. Hence, welding cables need to be regularly inspected for cuts or other damage to the insulation arising out of rough usage and, as well as the normal earthing of the cases of the welding machinery, the workplace itself should be earthed with a separate earthing cable wherever practicable. This cable should be capable of carrying the full welding current.

Suitable protective clothing and gloves should be worn but cannot be regarded as adequate protection against electric shock. Hence the electrode holder needs to be properly constructed and insulated to prevent accidental contact with live metal parts. Either hand held or helmet-type protective shields with appropriate visors are required to be worn to protect the facial skin and especially the eyes from damage due to ultra violet radiation.

Welding fumes are hazardous and appropriate extraction and respiratory equipment must be used (see COSHH code of practice)

NOISE

- a. The Noise at Work Regulations 1989

Damage to a person's hearing can be caused by noise. The degree of damage is a function of both the amplitude and frequency of the noise and its duration. Secondary hazards can also arise if the noise is such as to reduce the audibility of a warning sound.

As a general guide, the noise level is likely to be unacceptably high wherever a person has to shout to

communicate with someone about 2 metres away. Under these circumstances, the Safety Office should be contacted so that measurements of noise levels can be made and the results assessed against the legally tolerable levels. There are two such levels - 85 dB (A) and 90 dB (A) measured as an average over a day - and depending on where the noise level lies different action are required:

Suitable ear protectors must be worn where a person is exposed to a noise level above 90 dB (A). Between 85 dB (A) and 90 dB (A) employers must inform the employee of the hazard and associated risk and then need only provide protectors if the person subjected to the noise requests them, although it is strongly advised they do so if they are working for long periods under such conditions. Areas where ear protectors have to be worn are designated ear protection zones and need to be identified by means of the blue mandatory ear protection sign which can be obtained from the Safety Office.

There is also a third category of noise to cater for loud impacts or explosive noises of short duration. The level is set at a peak sound pressure of 200 Pascal's and above this level appropriate ear protectors must be selected and worn. Advice on the selection can be obtained from the Safety Office.

PERSONAL PROTECTIVE EQUIPMENT

- a. Personal Protective Equipment at Work Regulations 1992.
- b. Construction (Head Protection) Regulations 1989.

Personal protective equipment (PPE) includes protective clothing such as aprons, gloves, safety shoes, helmets, protective clothing for adverse weather conditions as well as equipment such as ear protectors, life jackets and respirators. Activities requiring the use of PPE are by definition hazardous and hence the activity should have been the subject of an assessment. The process of carrying out the assessment should ensure that the right PPE has been chosen for the activity and that it will be used correctly. However, it must be emphasised that PPE should only be used as a last resort, i.e. when all other means of removing or reducing the hazard have been exhausted.

Nevertheless, it is expected that workshop staff would be required to wear safety shoes at all times and protective glasses whenever they are operating machinery, whilst in laboratories the wearing of protective glasses and laboratory coats would be the norm.

PPE should be the subject of periodic inspection and maintenance to ensure its effectiveness at all times. Some equipment will require specialised servicing or maintenance i.e. breathing apparatus safety harnesses (examined by the University insurance company), whilst other equipment's will require periodic replacement due to time i.e. Safety Helmets. Departments must ensure that these are identified, registered and responsibilities allocated for their maintenance.

Safety helmets

Recently, head injuries have been a major source of concern in the construction industry and have given rise to the Construction (Head Protection) Regulations 1989. These require the wearing of head protection by all people on the sites of building operations and works of engineering construction.

All University staff visiting construction sites should be aware of these Regulations and wear head protection accordingly. Though not specified by the Regulations, there are many other situations within the University where the wearing of head protection is advisable - in laboratories and loading bays where heavy weights are being moved by gantry or crane. Head protection is also advisable where staff are working in confined spaces such as boiler rooms, bump hats are generally lightweight and comfortable and will also protect the head from overhead pipes etc.

It is important that only proven designs of head protection and, for that matter, PPE generally, should be worn. Details can be obtained from the Safety Office.

STORAGE OF FLAMMABLE LIQUIDS

- a. Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972
- b. HSE booklet HS(G)51 - Storage of Flammable Liquids in Containers
- c. HSG 140 – Safe Use and Handling of Flammable Liquids

The most important hazard associated with flammable liquids is accidental ignition and explosion followed by fire. This can give rise to extensive damage and injury to people if, due to bad storage arrangements, it is allowed to spread.

The University has properly designed stores for storing solvents and other flammable liquids in bulk. These are sited close to the main user departments and are managed and inspected in accordance with the Flammable Liquids Regulations (see reference above). Only small quantities, as required on a day-to-day basis, should be stored outside these flammable stores and should be kept to an absolute minimum.

These ready-use quantities should be:

- a. Stored in containers that are robust with well-fitting lids or screw tops to prevent spillage if knocked over. They should only be filled to the collar thereby allowing room for expansion. To prevent leakage, the container material must be compatible with the liquid being stored and the containers should be clearly marked as to their content and associated hazards.
- b. Stored in areas at least 2 m away from ignition sources, preferably in a fire-resisting cupboard or bin.
- c. They should not be stored in service ducts nor in any position that could present a hazard to fire exit routes.

Dispensing, mixing and similar operations should normally be done away from the storage areas and precautions taken should spillage occur, e.g. absorbent granules should be available near at hand to soak up any free liquid. In addition, adequate ventilation must be provided to extract and dissipate the fumes.

CONFINED SPACES

- a. The Confined Spaces Regulations 1997

A confined space means any place, including a chamber, pit, tank, vat, trench, pipe, sewer, flue or similar place, in which by virtue of its enclosed nature there could arise a reasonably foreseeable specified risk. This means that any room can be covered by the above regulations if there is one of the following specified risks: **concentrations of highly flammable liquids or gases, fire and explosion hazard due to oxygen enrichment, toxic gases, fumes or vapour, oxygen deficiency, excessive heat and drowning**, all leading to the potential for harm to employees, contractors, students and others. Departments have an **absolute duty** to ensure that the above regulations are complied with and that appropriate risk assessments are carried out. That safe working systems are formulated and, where appropriate, a permit to work system put into use. Situations where the regulations may apply are; paint spraying operations in workshops, work in boiler houses, roof voids, ventilation ducting etc. Activities that that may constitute a hazard in a confined space include; welding without extraction systems, use of hazardous substances such as solvents and glues (laying of floors), use of inert gases in rooms leading to oxygen deficiency (nitrogen to incubators etc), use/storage of flammable liquid and gases. Further information can be obtained from the Safety Office.

APPENDIX A

HSE LIST (NON-EXHAUSTIVE) OF WORK EQUIPMENT SUBJECT TO THE WORK EQUIPMENT REGULATIONS

Dumper truck	Ladder
Combine harvester	Mobile access platform
X-ray baggage detector	Car ramp
Check-out machine	Tranch sheets
Air compressor	Potato grading line
Lawn mower	Fire engine turntable
Automatic car wash	Resuscitator
Computer	Detonator
Crane	Microbiological safety cabinet
Power press	Photoelectric device
Road tanker	Lifting sling
Tractor	Portable sling
Lift truck	Scalpel
Power harrow	Soldering iron
Vehicle hoist	Hammer
Overhead projector	Meat cleaver
Dry cleaner unit	Butcher's knife
Drilling equipment	Robot line
Pit winding gear	Blast furnace
Reactor	Automatic storage/retrieval equipment
Scaffolding	Solvent degreasing bath
Cooling tower	LPG filling plant
Pressure vessel	Quarry crushing plant
Installed plant	Nickel plating line
Hand saw	Linear accelerator
Scaffolder's pudger	Drill bit
Socket set	

NOT WORK EQUIPMENT

Livestock, substances (e.g. acids, alkalis, slurry, cement, water), structural items (walls, stairs, roof), private car.

WORKSHOP SAFETY TRAINING RECORD

This form is to be completed by all non-workshop personnel who are to be granted the use of machinery within the workshop. Only relevant parts need to be completed although all items in section A can be considered mandatory.

Section A - Basic Safety Rules

Has the Student/Member of Staff been made aware of:-	Initials of Student/Member of Staff
1. Personnel Protective Equipment	1.
a. The need to wear appropriate eye protection.	a.
b. The need for wearing overalls or similar.	b.
c. The dangers of loose clothing i.e. loose/frayed cuffs, ties etc.	c.
d. The dangers of long hair.	d.
2. Housekeeping	2.
a. The housekeeping practices that are carried out within the workshop.	a.
b. The hazards associated with untidiness i.e. slips, trips and falls.	b.
3. Skin Care	3.
a. The risk of skin diseases associated with coolants and cutting oils.	a.
b. The requirement for good personnel hygiene practices.	b.
c. The location of washing facilities.	c.
d. The use of the appropriate skin cleansers and creams supplied.	d.
4. First Aid	4.
a. The whereabouts of medical facilities.	a.
b. The location and names of First Aiders.	b.
c. The necessity of having cuts and wounds treated immediately no matter how small.	c.
5. Fire	5.
a. The fire exit routes location of fire extinguishers and assembly point.	a.
6. Manual handling	6.
a. The correct method for lifting heavy objects.	a.
b. Not to try and lift heavy objects that are too heavy.	b.
7. Hand Tools	7.
a. The correct use of hand tools.	a.
b. Not to use equipment for a purpose it has not been designed for.	b.
c. Not to use damaged equipment.	c.
8. Fault/Damage reporting	8.
a. The importance of reporting faults/damage to equipment.	a.

9. Smoking	9.
a. The smoking policy and the location of smoking areas.	a.
10. Chemicals and Hazardous substances	10.
a. Details of the hazards and precautions to be taken of any hazardous substances they may use.	a.
11. General Safety	11.
a. The dangers of horseplay.	a.
b. The danger of airlines	b.
c. The dangers of distracting other people using machinery.	c.
d. The danger of burrs on machined metals and on damaged tools.	d.
e. The dangers associated with swarf and the correct methods for cleaning machines and the disposal of swarf.	e.

Section B - Machinery and Equipment

1. The following points are to be explained for each machine tool to be used:
 - a. The correct operating procedure.
 - b. Emergency stop positions.
 - c. Correct location of machine guards.
 - d. The importance of machine guards.
 - e. No go areas when the machine is operating.
 - f. No go areas on the machine.
 - g. The dangers of moving parts.

Machine Tool	a	b	c	d	e	f	g

Section C - Welding	
1. The hazards associated with:-	1.
a. Welding fume.	a.
b. Gas Welding.	b.
c. Electric Arc Welding.	c.
d. The personal protective equipment to be used.	d.
e. The dangers of arc eye.	e.
f. Correct gas bottle storage.	f.
g. Use of screens.	g.

Signature of Workshop Supervisor_____

Signature of Student/Member of Staff_____

Date_____

Statutory Inspections/Examinations

Ser	Equipment	Inspection Agency	Regulation	Periodicity	Departmental Action
1	Lifting Tackle and personal safety harnesses	University Insurance	FA & PUWER	6 Monthly	Ensure holdings reported to W&B's Monitor re-test dates
2	Lifting Machines	University Insurance	FA & PUWER	14 Monthly	Ensure holdings reported to W&B's
3	Local Exhaust Ventilation	Works & Buildings	COSHH 94	14 Monthly	Ensure Holdings reported to W&B's
4	Re-circulation and Biological Fume Cupboards	Hitchins (Local contract)	COSHH 94	14 Monthly	Report Holdings to Richard Harber (Path&Micro) Ext.7515
5	Standard Fume cupboards	Works & Buildings	COSHH 94	14 Monthly	Ensure holdings reported to W&B's
6	Pressure Systems	University Insurance	Press Systems & Transportable Gas Containers Regs 1989	12 monthly external, 24 monthly internal.	Ensure holdings reported to W&B's (Normally any system above 250 bar/litres although see Page 7 Pressure Systems. Will also include associated regulators and pipework) Report <u>all</u> pressurised equipment to W&B's for applicability.
7	Fork Lift Trucks (lifting chain)	University Insurance	FA & PUWER	6 Monthly	Ensure holdings reported to W&B's
8	Lifts (Passenger & Goods)	University Insurance	FA & PUWER	6 Monthly	Ensure holdings reported to W&B's
9	Fixed Electrical Installation	Works & Buildings	Electricity at Work Regs 1989	5 Yearly installation check (Residential 12 monthly earth loop)	Department to ensure checks carried out (keep date of last test/examination only)
10	Fixed Electrical Equipment	Works & Buildings	Electricity at Work Regs 1989	24 Monthly See Note *	Ensure holdings reported to W&B's
11	Portable Electrical Equipment	Departmental Responsibility	Electricity at Work Regs 1989	Various Periodicity See Note **	Department to raise appropriate register
12	Gas installations and appliances	Works & Buildings	Gas Safety (installation and use) Regs 1994	12 Monthly	Ensure annual examination carried out (keep date of last test/examination only)
13	Fire Extinguishers	Safety Office	Fire Regs	12 Monthly	Keep date of last test – Report overdue equipment.

Note* The periodicity may be extended on low usage equipment (refer to Safety Office)

Note** The periodicity will depend upon the equipment and the environment it is used in (refer to Safety Office)

- Factories Act 1961 (FA).
- Control of Substances Hazardous to Health Regs 1994 (COSHH)
- Provision and Use of Work Equipment Regs 1992 (PUWER)

The Works & Building contact for the above is Gary Spillane (Works Co-ordinator) Ext. 9103

